Tribhuvan University
Institute of Science and Technology
2016 (Revised version)

Structure of four year B. Sc. Meteorology course

Year	Theory	FM	Practical	FM
First	General Meteorology and Climatology (50+50) MET 101	100	General Meteorology and Climatology Practical MET 102	50

First year

General Meteorology and Climatology

Course Title: General Meteorology and Climatology

Course Number: MET 101 Full Marks: 100

Nature of Course: Theory Pass Mark: 35

Course Objectives:

The General Meteorology and climatology course is designed to provide basic knowledge on introductory matters of Meteorology and climate science. In addition, the physical causes of the climate and its variation in both space and time are provided.

Group A: General Meteorology (Theory)

Atmospheric composition, mass and structure: Total atmosphere, Variations with height, Variations with latitude and season, Variations with time 2 hrs

Mass of the atmosphere: total pressure, vapor pressure 1 hr

The layering of the atmosphere: Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere and magnetosphere 2 hrs

Solar radiation and the global energy budget: Solar radiation, Solar output, Distance from the sun, Altitude of the sun, Length of day 2 hrs

Surface receipt of solar radiation and its effects: Energy transfer within the earth–atmosphere system, Effect of the atmosphere, Effect of cloud cover, Effect of latitude, Effect of land and sea, Effect of elevation and aspect, Variation of temperature with height 4 hrs

Terrestrial infrared radiation and the greenhouse effect 1 hr

Heat budget of the earth 1 hr

Atmospheric energy and horizontal heat transport: The horizontal transport of heat, Spatial pattern of the heat budget components 2 hrs

Atmospheric moisture budget 2 hrs

The global hydrological cycle 1 hr

Humidity: Moisture content, Moisture transport 1 hr

Evaporation and Condensation 2 hrs

Precipitation characteristics: Forms of precipitation, Precipitation characteristics: Rainfall intensity, Areal extent of a rainstorm, Frequency of rainstorms, The world pattern of precipitation, Regional variations in the altitudinal maximum of precipitation, Drought 3 hrs

Acid precipitation 1 hr

Air stability and instability 1 hr

Atmospheric instability, cloud formation and precipitation processes:

Condensation nuclei, Cloud types, Global cloud cover 3 hr

Adiabatic temperature changes 1 hr

Formation of precipitation: Bergeron–Findeisen theory, Coalescence theories, Solid precipitation 3 hrs

Precipitation types: 'Convective type' precipitation, 'Cyclonic type' precipitation, Orographic precipitation 2hrs

Thunderstorms and its types 2 hrs

Mesoscale convective systems 2 hrs

Atmospheric motion: principles 2 hrs

Laws of horizontal motion: The pressure-gradient force, The earth's rotational deflective (Coriolis) force, The geostrophic wind, The centripetal acceleration**,** Frictional forces and the planetary boundary layer 5 hrs

Divergence, vertical motion and vorticity: Divergence, Vertical motion, Vorticity

3 hrs

Local winds: Mountain and valley winds, Winds due to topographic barriers, Land and sea breezes 3 hrs

Planetary-scale motions in the atmosphere and ocean 4 hrs

Variation of pressure and wind velocity with height: The vertical variation of pressure systems**,** Mean upper-air patterns, Upper wind conditions, Surface pressure conditions 6 hrs

The global wind belts: The trade winds, The equatorial westerlies, The mid-latitude (Ferrel) westerlies, The polar easterlies 8 hrs

The general circulation: Circulations in the vertical and horizontal planes**,** Variations in the circulation of the northern hemisphere 7 hrs

Text Book:

- R.G. Barry and R.J. Chorley, Atmosphere, Weather and Climate, Holt, Rinehart and Winston, Inc

Group B: Climatology (Theory)

Introduction to the climate system: Atmosphere, Ocean and land surface, atmospheric temperature, atmospheric composition, weather and climate, Definition and scope of climatology, sub-division of climatology, Factors affecting climate. 10 hrs

Precipitation: Precipitation process, Ice-crystal theory, Collision-coalescence theory, Forms of precipitation, Types of precipitation, Seasonal variation of precipitation, Diurnal variation of precipitation. 8 hrs

Heat exchanges in the atmosphere: Solar radiation, insolation, terrestrial radiation, heat exchange process, the energy budget of the atmosphere, the effect of radiation at the earth's surface, temperature difference between land and sea surface, albedo 12 hrs

Air Masses: Definition and Characteristics, source region, air mass modification, classification of air mass 7 hrs

Classification of climate, their type and distribution: Need and objectives of classification, basis of classification, Koppen's classification, Thornthwaites classification, Tropical rainforest climate, savanna climate, tropical monsoon climate, Sahara type climate, low-latitude steppe climate, middle-latitude steppe climate, middle-latitude desert climate, Mediterranean climate, china type of climate, temperate oceanic climate, humid continental climate, hot summer climate, humid continental mild summer climate, taiga climate, Tundra climate, ice-cap climate, high land climate. 20 hrs

Climate of Nepal: East West variation, orographic variation, western disturbances, Convection in pre and post monsoon, summer monsoon. 12 hrs

Climate Change and its Impacts: Introduction, Green House Gases (GHGs), anthropogenic change of climate, Impact of climate change in Nepal. 6 hrs

Text Books

- Dennis L. Hartmann, 1994, Global Physical Climatology, International Geophysical Series, Academic Press

- Lal, D.S., Climatology, Sharda Pustak Bhawan, Allahabad, India, Revised and enlarged edition 2001

Reference Books

- Sellers. W. D., Physical climatology, University of Chicago Press.
- Conrad, V. and Pollack, L., W., Methods in Climatology, Second edition, HARVARD University Press, Massachusetts, 1962.
- Chritchfield, H. J., General Climatology, Prentice Hall of India Private Limited, New Delhi, 1975.

General Meteorology and Climatology Practical

Course Title: General Meteorology and Climatology Practical

Course Number: MET 102 Full Marks: 50

Nature of Course: Practical Pass Mark: 20

Group A: General Meteorology (Practical)

Practical 1: Meteorological observatory- site selection and types using WMO practice

Practical 2: Introduction of Stevenson screen

Practical 3: Minimum maximum thermometer for temperature measurements

Practical 4: Dry bulb and wet bulb temperature (Psychrometer) for dew point determination

Practical 5: Measurement of precipitation

Practical 6: Sunshine recorder for diurnal hours

Practical 7: Anemometer and wind vane for wind speed and direction measurements

Practical 8: Measurement of Pressure by using Kew Patten's Barometer

Practical 9: Measurement of Pressure by using and Fortin Barometer.

Practical 10: Introduction of AWS

Practical 11: Measurement of evaporation.

Practical 12: Identification of clouds using cloud atlas.

Practical 13: Meteorological station visit and report preparation (3 days)

Group B: Climatology (Practical)

Practical 1: Determine the principle climatic types to which each of them belongs by using koppen climatic classification method.

Practical 2: The rain fall of station A from 1981 to 2000 is given, (a) find out the magnitude of rain fall with probability of 50% and 25% (b) what will be the probability corresponding to rainfall of 1460mm.

Practical 3: Given below is the mean temperature of January of station 'A' from 1981 to 2010. Calculate the moving average (5 years running mean). Plot year Vs mean in the same graph. Comment the two graphs.

Practical 4: Compare potential evapotranspiration (PET) estimated by the Thronthwaites method and evaporation obtain by pan and relate them with seasonal precipitation with the given data of a station.

Practical 5: Computation and interpretation of annual average, standard deviation, and coefficient of variation (rainfall and temperature) of a given station of Nepal.

Practical 6: Computation of moving average and interpretation of monthly climatological summary

Practical 7: Compute and plot rainfall standard anomaly of given series for the period 1971-2010 and interpret.

Practical 8: Compute and plot temperature standard anomaly of given series for the period 1971-2010 and interpret.

Practical 9: Computation of water balance parameter using Thornthwaite method

Practical 10: Computation of energy balance parameter using Thornthwaites method

Practical 11: Compute the linear trend of given data (temperature and rainfall)

Practical 12: Learning a thermodynamic diagram (Skew-T LogP, t-phi gram)

Practical 13: Plot the sounding data and determine significant levels

Practical 14: Interpretation of Satellite IR, Water vapor images of different case